LWG RESPONSE TO EPA'S PRINCIPAL THREAT WASTE APPROACH

This document provides the Lower Willamette Group (LWG)'s response to the U.S. Environmental Protection Agency's (EPA)'s revised Feasibility Study (FS) memoranda regarding the identification and evaluation of Principal Threat Waste (PTW) at the Portland Harbor Superfund Site (Site). EPA's PTW memoranda were prepared by CDM Smith and include *Identification of Principal Threat Waste at the Portland Harbor Superfund Site* (dated April 10, 2014) and *Evaluation of Principal Threat Waste at the Portland Harbor Superfund Site* (dated June 6, 2014) (CDM Smith 2014a and 2014b, respectively). This response is provided to facilitate resolution of outstanding issues as part of the non-binding information exchange process for the revised FS.

OVERALL RESPONSE AND PROPOSED ALTERNATIVE APPROACH

A precise identification and highly quantitative evaluation of PTW at the Site is not necessary or productive for completing the revised FS and ultimately for EPA's selection of a remedial alternative. In addition, EPA's proposed approach is inconsistent with guidance on PTW and with how EPA has addressed PTW at other large river sediment remediation sites. This conclusion is based on the following three factors:

- EPA's PTW 1991 guidance. It states "…principal threat/low level threat waste concept and the NCP expectations were established to help streamline and focus the remedy selection process, not as a mandatory waste classification requirement." The guidance further notes "…In some situations site wastes will not be readily classifiable as either a principal or low level threat waste, and thus no general expectations on how best to manage these source material of moderate toxicity and mobility will necessarily apply." The PTW concept for this Site and sediment sites in general does not aid in streamlining and focusing the remedy selection, nor are sediments at the Site readily classifiable. And the 1991 guidance clearly anticipated these as site-specific circumstances that would make application of the PTW concept unsuitable in a precise or highly quantitative manner.
- Other sediment site examples. LWG has reviewed eleven other large sediment sites where the general approach has been to avoid prescriptive procedures for identifying and quantifying PTW. Also, we are unaware of any other large sediment site where the 10^{-3} cancer risk level threshold was applied to sediments in a highly quantitative manner. Rather, at these other sites the approach has been more general in evaluating PTW by complying with the intent of the PTW concept through use of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) FS criteria. Specific site examples and more discussion on their approach are provided in the next section.
- EPA's memoranda on PTW. LWG disagrees with many of the technical conclusions on identifying and evaluating PTW presented in the April 10 and June 6 memoranda, and ultimately with EPA's interpretations of the PTW concept for this Site. Specific issues and responses on these memoranda are provided in subsequent sections.

Based on this analysis, LWG proposes developing, in coordination with EPA, a more general approach to the PTW concept that is similar to other sediment site examples listed in the next subsection. Specifically, a general approach would describe the extent to which a range of appropriate remedial technologies (including treatment) is being included across all areas and alternatives, particularly in areas with relatively higher Site sediment concentrations. This discussion would also examine the amount of removal, which often includes treatment in sediment dewatering and handling processes. The resulting alternatives can then be evaluated for performance relative to all the CERCLA FS criteria, as well as general compliance with the overall intent of the PTW concept.

Specific responses related to EPA's proposed PTW approach are provided in the subsection entitled "LWG Responses to EPA's Identification of Principal Threat Waste."

EXAMPLES OF HOW EPA HAS ADDRESSED PRINCIPAL THREAT WASTE AT OTHER SEDIMENT SITES

The LWG proposal for a general identification and evaluation approach to the PTW concept is entirely consistent with the approach at many other large sediment remediation sites including the following:

- At the Lower Passaic River, EPA's response to National Remedy Review Board/Contaminated Sediment Technical Advisory Team (NRRB/CSTAG) comments on PTW (EPA 2014) states:

  > "According to the guidance, 'the principal threat/low level threat waste concept and the NCP expectations were established to help streamline and focus the remedy selection process, not as a mandatory waste classification requirement' (p. 2)… In preparing the FFS [Focused Feasibility Study] for the lower 8.3 miles of the Lower Passaic River, the Region concluded that the principal threat/low level threat waste concept does not help streamline and focus the remedy selection process."

- At the Housatonic "Rest of the River" site, EPA's response to the NRRB/CSTAG comments on PTW (EPA 2012) states:

  > "EPA's Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA, 2005) states that although the NCP provides a preference for treatment for "principal threat waste",[sic] treatment has frequently not been selected for contaminated sediment. High costs, uncertain effectiveness, and/or community preferences (for on-site operations) are factors that lead to treatment being selected infrequently at sediment site[sic]…Also, [i]t should be recognized that in-situ containment can also be effective for principal threat wastes, where that approach represents the best balance of the NCP nine remedy selection criteria."

- At the Fox River, the 2002 Record of Decision (ROD) for Operable Units (OUs) 1 and 2 (EPA and WDNR 2002) states:

> "With respect to the Fox River sediments in OU 1, some PCB concentrations create a risk in the range of 10^{-3} or more. The preference for treatment outlined above applies to these particular sediments. However, it would be impracticable to closely identify, isolate and treat these principal threat wastes differently than the other PCB sediments in OU 1. The dredging technology that will be employed to accomplish the OU 1 remedy does not distinguish among gradations of contamination in source materials. Nevertheless, at the conclusion of the OU 1 remedy the source materials (and principal threat wastes) will have been removed from the River, dewatered, and deposited in a landfill. In so doing the mobility of the principal threat wastes will have been greatly reduced."

- At the Lower Duwamish River, the Proposed Plan (EPA 2013a) states:

  > "EPA has determined that contaminated sediment to be addressed in the LDW by this Proposed Plan generally is low-level threat waste; however, treatment was included for some alternatives."

- At the Grasse River, the ROD (EPA 2013b) states:

  > "EPA does not believe that treatment of the principal threat wastes is practicable or cost effective given the widespread nature of the sediment contamination and the high volume of sediment that would need to be addressed."

- At Onondaga Lake, the New York Department of Environmental Conservation and EPA state in the ROD (EPA and NYSDEC 2005) that:

  > "Given the extraordinary volume of materials being evaluated (e.g., greater than 4,000,000 cy [3,060,000 m^3] of sediments and wastes within the ILWD [in lake waste deposit], some of which contain NAPLs), treatment of all principal threat wastes (which are present in various portions of the ILWD) is impracticable. However, the implementation of any of these alternatives would include the off-site treatment and/or disposal of all NAPLs that would be segregated during the dredging/handling process. The appropriate means for collecting and handling these sediments and materials would be determined during the remedial design."

In all six examples, EPA has addressed the PTW concept in a general fashion. The presence of possible PTW was generally recognized in each case, but PTW areas were often not specifically identified and treatment was not specifically applied to all potential PTW areas in the alternative evaluations. All of these approaches adhere to the principles of the PTW guidance concept that "…the NCP expectations were established to help streamline and focus the remedy selection process, not as a mandatory waste classification requirement…" (emphasis added). Finally, often the general discussion of the appropriate role of treatment in the remedy for both PTW and low level wastes included practicability issues related to treatment of large areas or volumes of sediment. LWG is proposing a similar approach.

LWG RESPONSES TO EPA'S IDENTIFICATION OF PRINCIPAL THREAT WASTE

EPA's memoranda (CDM Smith 2014a and 2014b, respectively) use a narrow interpretation of the PTW guidance (EPA 1991) that results in large portions of the Site being potentially identified as PTW. EPA's narrow interpretation yields an invalid conclusion that sediment concentrations associated with some of the lowest alternative Remedial Action Levels (RALs; e.g., Alternative E RAL for PCBs of 0.2 parts per million [ppm]) are PTW. This technically unsupported conclusion illustrates that EPA's narrowly focused interpretation of the PTW guidance is arbitrary and capricious. More importantly, it does not facilitate the identification and application of appropriate remedial technologies across the Site. As described in EPA's 1991 guidance, PTW are "those source materials considered to be highly toxic or highly mobile that cannot generally be reliably contained." In the following subsections, LWG will illustrate where EPA's memoranda are inconsistent with that 1991 PTW guidance.

Reliably Containable Evaluation

Per the draft FS, the vast majority of the sediments in the Site are demonstrated to be likely reliably containable through the detailed and quantitative containability analyses presented in draft FS Sections 5.5.2, 6.2.5.1, and 6.2.6.1 and supported by detailed calculations in Appendix Hc. This finding is entirely consistent with other contaminated sediment sites including the following, for example:

- At the Lower Duwamish River, the maximum sediment polychlorinated biphenyls (PCB) concentration was 220 parts per million (ppm), and EPA determined that site sediment "generally is low-level threat waste" (EPA 2013a). (In comparison, at Portland Harbor the maximum PCB concentration is 36 ppm and EPA is identifying concentrations of 0.2 ppm as potential PTW.)
- At the McCormick and Baxter Site within the Portland Harbor Site, sediments containing non-aqueous phase liquid (NAPL) and PAHs were reliably contained using conventional and active capping technologies, and the Oregon Department of Environmental Quality and EPA continue to conclude those materials have been reliably contained (DEQ and EPA 2011).
- At the Fox River, EPA determined that some sediment in excess of 50 ppm PCBs could be reliably contained (capped) in place to provide a protective remedy (EPA and WDNR 2007).
- At the Zidell site, sediments with PCB concentrations in excess of 1 ppm were included within the cap design boundary under DEQ authority (Maul Foster 2009).

Consistent with these precedents from other sites, because sediments at the Portland Harbor Site are reliably containable (as demonstrated in the draft FS), they should not be considered PTW.

During FS technical meetings, EPA indicated that it is unable to fully assess the containability aspect of the PTW guidance during the FS phase. As a result, EPA proposes in the April 10 memorandum to identify and evaluate PTW for FS-level determinations using only the highly toxic and highly mobile aspects of the PTW guidance. LWG strongly disagrees with this approach.

However, in EPA's June 6 memorandum, EPA indicates that capping-based alternatives for PTW will incorporate reactive materials to "ensure that they can be reliably contained" and to meet the National Contingency Plan (NCP) expectation regarding treatment of PTW to the extent practicable. If the sediments in question can be reliably contained either with or without reactive materials in a cap, the sediments do not constitute PTW as defined in the guidance. The June 6 memorandum indicates that EPA has in fact determined for FS-level purposes that potentially highly toxic and/or highly mobile materials can be reliably contained at the Site.

In summary, EPA should not conduct an evaluation of the highly toxic and highly mobile aspects of PTW without also including containability evaluations because that analysis would be inconsistent with the PTW guidance, precedents at other sites, and EPA's own conclusions at this Site.

Highly Toxic Identification

Overall, EPA does not accurately assess the presence of greater than 10^{-3} cancer risk at the Site consistent with the intent of the guidance. For total PCBs, dioxin/furan Toxic Equivalent (TEQ) and total 2,4′ and 4,4′-DDD, -DDE, -DDT (DDx), EPA multiplied by 1,000 certain 10^{-6} cancer risk preliminary remediation goals (PRGs) based on human health fish consumption (high consumption rate, mixed diet, fillet only) to determine concentrations associated with 10^{-3} cancer risk[1]. For benzo(a)pyrene equivalent (BaPEq), EPA followed the same procedure using a sediment direct contact PRG for high frequency fisher.

However, before applying such concentrations for PTW identification, the presence of actual risks greater than 10^{-3} needs to be determined. In fact, greater than 10^{-3} risk was not found in the Baseline Human Health Risk Assessment (BHHRA) for dioxin/furan TEQ, total DDx, or BaPEq for any scenario evaluated. Therefore, the definition of highly toxic as described in EPA 1991 is only potentially applicable to total PCBs.

For total PCBs, greater than 10^{-3} cancer risk was found in the BHHRA for three fish consumption scenarios: subsistence (mixed diet, fillet), recreational (mixed diet, fillet), and tribal (whole body and fillet). Given that the guidance was written in 1991, it appears unlikely that those authors contemplated fish consumption as an exposure route to identify PTW. The guidance states:

> "Source material" is defined as material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, to surface water, to air, or acts as a source for direct exposure." [emphasis added].

The fish consumption risks do not represent direct exposures from source materials, but rather integrate contaminant contributions from sediment, surface water, and diet. As a consequence, the sediments by themselves may not pose risks greater than 10^{-3}. In addition, contaminants in fish do not represent a reservoir for migration of contamination to other media.

[1] The guidance indicates that no threshold level of toxicity/risk has been established to equate to principal threat, but suggests that material presenting a risk of 10^{-3} or greater may be considered a principal threat.

In summary, only contaminants that were actually found to pose greater than 10^{-3} cancer risk in media that potentially represent a source to other media or of direct exposure should be evaluated for the highly toxic aspect of the PTW definition, and only in those areas where that level of risk was found to occur in the baseline risk assessments. No contaminants meet these conditions at this Site.

Highly Mobile Criterion

Overall, EPA uses inapplicable and inferential evidence to identify potentially highly mobile material in a manner that is inconsistent with the intent of the PTW guidance. The highly mobile aspect of the PTW definition should be applied for NAPL consistent with situations described in the guidance (EPA 1991), such as "pools of NAPLs submerged beneath ground water or in fractured bedrock, NAPLs floating on ground water" or where physical processes are likely to mobilize "source materials" as defined in the guidance. LWG disagrees with EPA's various lines of evidence, which are more fully discussed below.

Gasco Substantial Product - EPA uses the definition of "substantial product" at the Gasco sediment site in concluding those sediments meet the PTW highly mobile criterion, even though, per EPA's April 10 memorandum, that definition includes "solid tar layers" and is "therefore more expansive than simple observance of liquid NAPL."

Although PTW can include solid materials, the highly mobile criterion is specific to "liquids and other highly mobile materials (e.g., solvents)" or source materials that are mobile due to physical processes (EPA 1991). Thus, "substantial product" cannot be used as equivalent to "highly mobile" in applying the criteria in PTW guidance. Solid tar is not necessarily highly mobile solely by its presence in Site sediments. EPA recognizes this in its June 6 memorandum, when deciding that pencil pitch at Terminal 4 (T4) is not indicative of highly mobile material because it is a solid. The same rationale applies to solid tars at Gasco. By the same logic, at the Arkema Site dichloro-diphenyl-trichloroethane (DDT) is a highly insoluble solid and, therefore, is also not highly mobile.

Further, within the Gasco Sediments Order, substantial product is defined as a preference for removal, which is different than the preference for treatment under PTW guidance. The two concepts cannot be used interchangeably. It is inappropriate to use the Gasco substantial product definition for the identification of PTW. In summary, the same methods for determining potentially highly mobile material should be applied to all areas of the Site.

NAPL Observations - EPA uses visual observations such as "blebs, globules" and "other terms indicating the presence of product…in any quantity greater than what could be characterized as sheen" to identify PTW. EPA also uses other lines of evidence for the presence of NAPL, such as "sheens and odors along with corresponding elevated organic vapor readings" and the "documented presence of DNAPLs in upland soils." EPA also seems to ignore the fact that naturally occurring lipids and long chain fatty acids can exhibit "sheens" that may appear as a potential NAPL.

All of these NAPL identification methods are inconsistent with the concept of free phase NAPL as defined in PTW guidance text, which discusses the conditions of "pooled NAPL" as described

above. The guidance clearly focuses on pooled NAPL that can migrate because of its liquid nature. Isolated blebs and globules (and similar trace evidence of product) are not analogous to migrating pools of NAPL. Sheens, odors, and vapor meter readings are not analogous to migrating pools of NAPL. The presence of NAPLs in upland soils does not indicate anything about NAPL in offshore sediments, particularly when many direct observations of sediment cores without NAPL observations are available.

EPA cites Cohen and Mercer (1993) as support for these methods; however, Cohen and Mercer (1993) clearly distinguish between mobile and immobile dense non-aqueous phase liquid (DNAPL) and state that any observation of trace DNAPL does not equate to high mobility (for an initial example, see the discussion in Section 6.2.3 of Cohen and Mercer [1993]). At the Arkema Site, continuous cores have been visually logged and hundreds of samples have been analyzed at the laboratory and, to date, no chlorobenzene NAPL has been found in Arkema sediments.

In summary, EPA should not use indirect lines of evidence (e.g., sheens, odors, vapor readings) or trace NAPL observations (e.g., blebs, globules) to determine potentially highly mobile material at the Site.

Solubility Limits and Csat Calculations - EPA uses concentrations in transition zone water (TZW) and offshore groundwater exceeding 1% solubility and bulk sediment Csat calculations as an indication of NAPL near the Arkema Site. The PTW guidance discusses direct observations of NAPL rather than indirect estimates of potential saturation. Both the 1% solubility limit method and the Csat method are evaluating potential levels of groundwater contamination, not identifying a mobile source liquid, and as such should not be used as lines of evidence for PTW. PTW guidance states that "contaminated ground water…is not considered to be a source material, and thus would not be categorized as a principal threat" (EPA 1991).

Cohen and Mercer (1993) distinguish between "determinant, inferential, and suggestive" indications of DNAPL (Table 7-4 of Cohen and Mercer [1993]). Direct DNAPL observations are "determinant" evidence, whereas solubility limits are "inferential." Inferential and suggestive evidence generally leads to further investigations using determinative methods to confirm the presence of DNAPL. Similarly, Pankow and Cherry (1996) states: "This value [i.e., the 1% solubility limit] should not be viewed as strict criterion since, based on the above discussion, we know that the magnitude of the dissolved concentrations observed in a monitoring well depend on factors other than the presence or absence of DNAPL phase source zones…The use of the 1% rule of thumb in any assessment of the spatial distribution of DNAPL zones must be performed cautiously, particularly in the downgradient direction."

It is not technically valid to make PTW decisions based on this inferential line of evidence when more direct determinant evidence (many sediment core observations) is already available in the same sediments. Furthermore, to apply the 1% solubility rule to contaminants that are in a solid state at standard temperatures and pressures (e.g., DDT) is technically unsupportable and inappropriate.

In addition, conducting 1% solubility limit calculations using unfiltered trident TZW and groundwater geoprobe data is technically incorrect. As discussed in the draft Remedial Investigation, these unfiltered samples contain entrained suspended sediment with adsorbed contaminants that do not represent dissolved phase concentrations, thus elevating the sample results. Conversely, the solubility calculations assume that only dissolved phase contaminants are being measured in the water sample. As a result, even as inferential evidence, these calculations are highly uncertain, and biased toward higher concentration results that are not indicative of dissolved phase contaminants.

Based on these inferential methods, EPA identifies six sediment borings near the Arkema Site as containing NAPL and PTW. The LWG does not agree that any of these borings contain highly mobile material consistent with the definition of PTW.

EPA also uses theoretical Csat calculations in a more general Site-wide evaluation of sediments. Per above, this is an inferential line of evidence that should not be used when determinant evidence from many sediment observations is available in the same cores and surface sediment samples where this calculation was applied.

It appears in the June 6 memorandum that EPA agrees that inferential theoretical solubility limits based on high biased water samples should not be used to identify NAPL in sediments: "Sediment contaminant concentrations exceeding a contaminant's corresponding theoretical solubility limit in pore water represents indirect evidence of the presence of NAPL and must be confirmed by observations of NAPL." Therefore, LWG recommends that solubility limits and Csat calculations not be presented in the revised FS, given observations about NAPL are available in the same samples and will control this determination.

Additional Detailed Responses

The primary LWG responses on PTW are described above. LWG also has the following additional detailed responses.

April 10 Memorandum Responses

1. LWG disagrees with EPA's interpretation that "sediments" are generally defined as source materials in the PTW guidance (EPA 1991). This is a mischaracterization of the discussion in the guidance of sediments as a type of "sludge" (as opposed to naturally occurring sediments).
2. None of the contaminants listed in Table 1 of the April 10 memorandum as "Other Portland Harbor COCs" were found to pose risks greater than the 10^{-3} cancer risk level in the BHHRA. Consequently, these contaminants should not be evaluated for the highly toxic aspect of PTW (see discussion above).
3. EPA indicates that the fish consumption pathway represents the greatest risk for BaPEq. This is incorrect and inconsistent with the conclusions of the EPA-approved BHHRA, which concluded that cancer risks for human fish consumption for BaPEq were not more than $6x10^{-6}$. Given that risks in excess of 10^{-3} were not found for this (or any other) scenario for BaPEq, a highly toxic aspect of PTW should not be evaluated for this scenario/contaminant, even if it was technically possible.

4. The highly toxic threshold should not be applied to subsurface sediments because those sediments generally do not have an existing exposure pathway that results in unacceptable risks, particularly at a 10^{-3} cancer risk level.
5. EPA states that any one line of evidence of highly toxic or highly mobile can be an indication of PTW. This is inconsistent with the guidance, which states, "No "threshold level" of toxicity/risk has been established to equate to "principal threat." However, where toxicity and mobility of source material combine to pose a potential risk of 10^{-3} or greater, generally treatment alternatives should be evaluated" (emphasis added; EPA 1991).
6. EPA notes the Lower Duwamish Proposed Plan (EPA 2013a) implements guidance regarding NAPL floating on groundwater, pooled under groundwater, or located in fractured bedrock as PTW. It is also worth noting that the Lower Duwamish Proposed Plan identifies no such PTW existing anywhere at that site, as noted above. This differs significantly from EPA's broad interpretation using inferential evidence of the highly mobile concept in Portland Harbor.

June 6 Memorandum Responses

1. EPA indicates that in situ treatment will not be included in alternatives for PTW areas because further evaluation of this technology is needed. Based on the detailed technical information contained in Section 6.2.4 of the draft FS and subsequent additional pilot- and full-scale implementation of this technology at several other sites, EPA should not screen out in situ treatment from application to any Site sediments. In situ treatment is a sufficiently proven technology to support its inclusion in an FS-level analysis. EPA does not provide any rationale or technical explanation for the general assumption that in situ treatment needs further evaluation.
2. EPA indicates that any capping-based alternatives for PTW should include incorporation of active materials because of EPA's concern that conventional capping may not reliably contain NAPL-based PTW. Decisions about the ability of conventional versus active caps to effectively remediate sediments should be based on technical evaluations and calculations, not general assumptions based on a categorization of potential PTW. As identified in the draft FS Sections 5.5.2, 6.2.5.1, and 6.2.6.1 and supported by Appendix Hc, some areas of Site sediments can be effectively remediated using conventional caps and some areas would likely require active caps. These decisions need to be based on this type of technical analysis and subarea considerations.
3. EPA indicates that NAPL-based PTW will consider the need for more aggressive water quality controls (e.g., sheetpile containment), which appears to be a general assumption. Section 6.2.7.3 of the draft FS contains detailed information on the effectiveness and general pros and cons of various types of dredge containment. These evaluations or ones like them should be used to make technology selection decisions for alternatives development, not general unsupported assumptions.
4. EPA indicates that NAPL-based PTW would not be considered for placement in confined disposal facilities (CDFs). However, the presence of trace amounts of NAPL (e.g., blebs, globules, sheens) does not equate to pools of free phase NAPL as discussed in the PTW

guidance and would meet the acceptance criteria of properly designed CDFs including the current T4 CDF design. Also, EPA should clarify these statements by including the qualification "without adequate treatment." An unqualified stipulation that sediments containing NAPL are not eligible for placement in a CDF would be inconsistent with previous decisions by EPA on CDF acceptance criteria (e.g., the T4 CDF 60% design).

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